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Granholm

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[54] **SLIDE RULE FOR COMPUTING MOTOR BOAT PERFORMANCE**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 405,041, Oct. 10, 1973, abandoned.

[52] **U.S. Cl.** ..... **235/70 A;** 235/85

[51] **Int. Cl.²** **G06G 1/02;** G06C 3/00

[58] **Field of Search** ..... 235/70 A, 70 R, 78, 84, 235/85, 89

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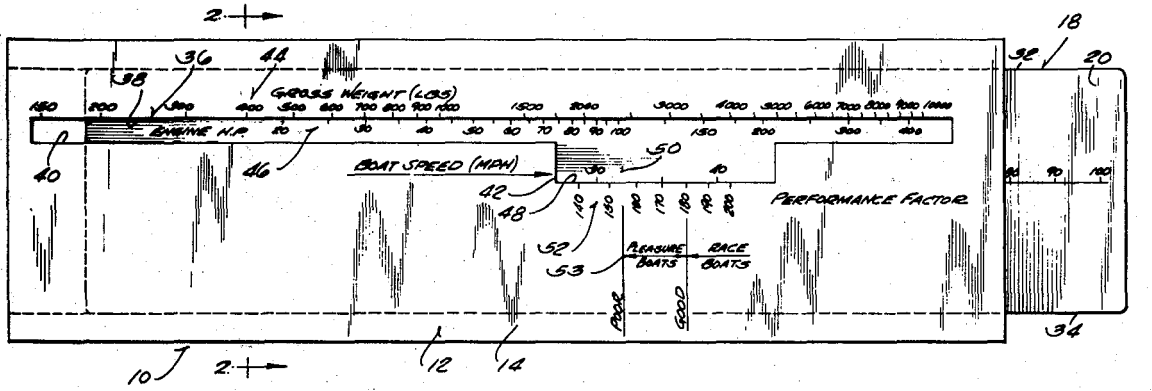
[57] **ABSTRACT**

Disclosed herein is a slide rule device including a base member and a slide member which is slidably carried by the base member. Each member has a pair of logarithmic scales which are located in spaced relation on the front faces thereof and are calibrated to respectively indicate boat gross weight, engine horsepower, boat speed and a boat performance factor which is a function of the boat gross weight, engine horsepower and boat speed and is indicative of boat performance. These scales are arranged in interrelationship on the members so that the performance factor for a boat having a known gross weight, propelled by an outboard motor or stern drive having a known horsepower, and having a known speed can be easily computed by simply moving the slide member relative to the base member to align the appropriate values of the gross weight and engine horsepower scales. Once the performance factor for a boat has been computed or estimated, the predicted speed of the boat, when there is a change in gross weight and/or engine horsepower, can be computed by aligning the appropriate values on the gross weight and engine horsepower scales.

9 Claims, 4 Drawing Figures



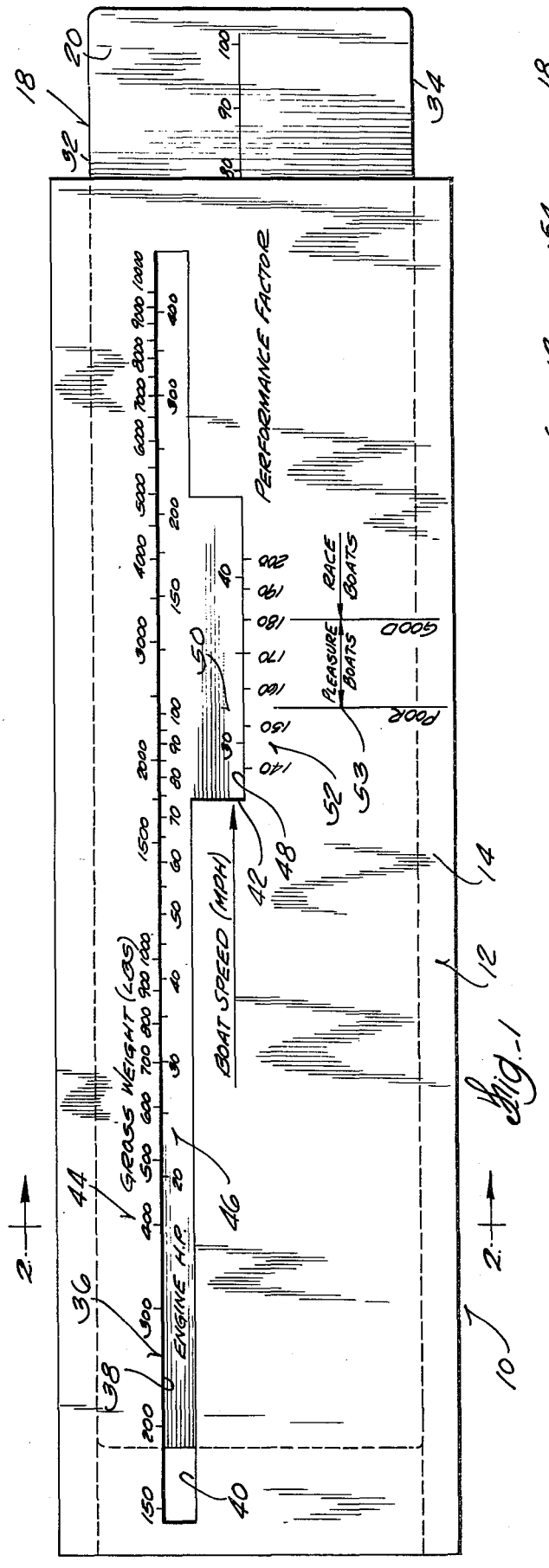


Fig. 1

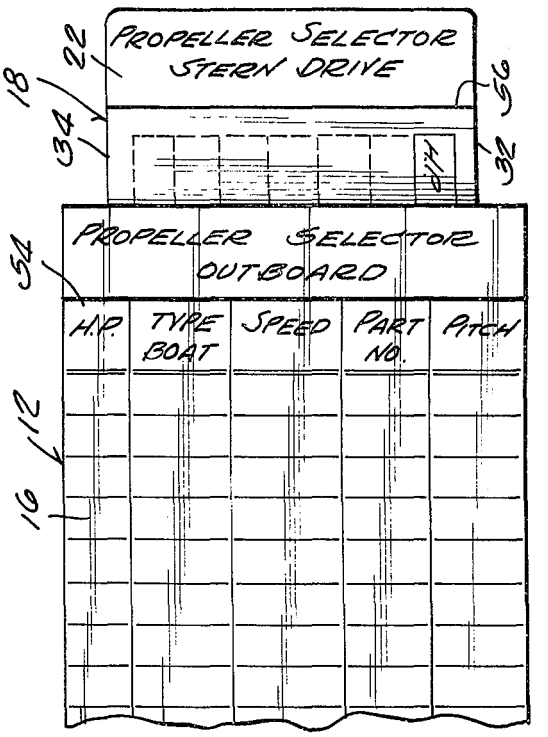


Fig. 3

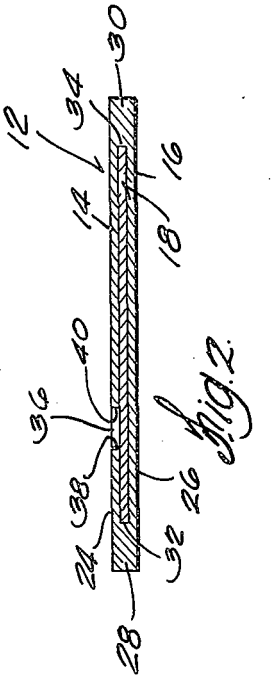
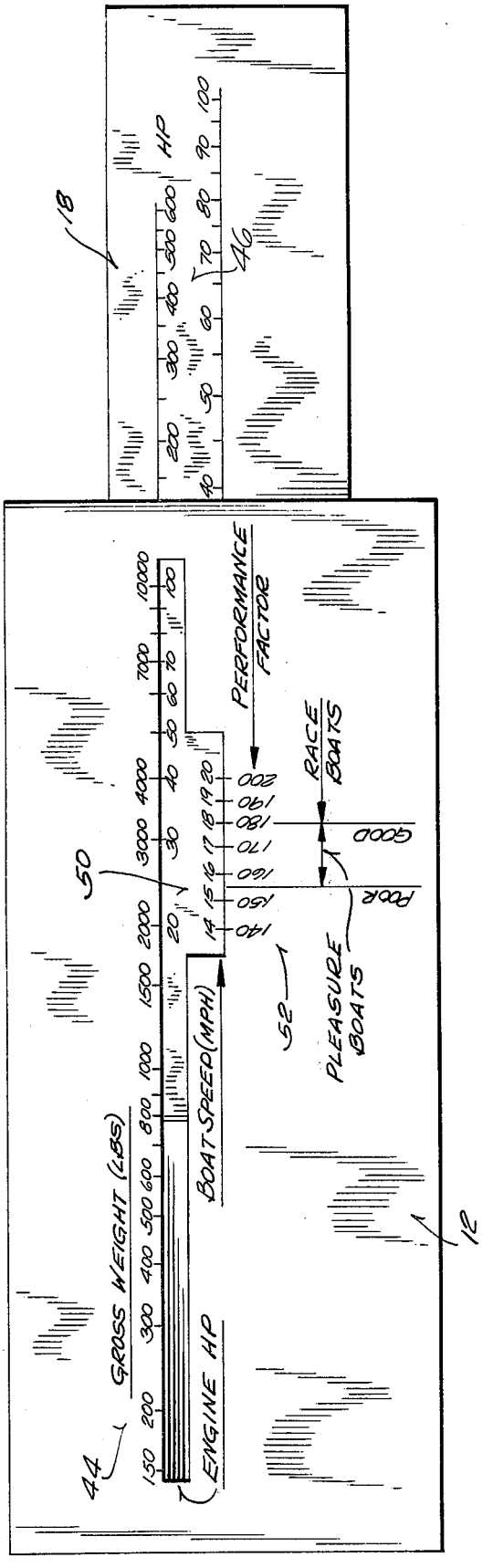


Fig. 2

Fig. 4


18
HP
40
60
70
80
90
100
200
300
400
500
600
46
PERFORMANCE FACTOR
RACE BOATS
GOOD
POOR
PLEASURE BOATS
50
52
12
44
GROSS WEIGHT (LBS)
BOAT SPEED (MPH)
ENGINE HP
150
200
300
400
500
600
800
1000
1500
2000
3000
4000
7000
10000
14
15
16
17
18
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20
140
150
160
170
180
190
200

SLIDE RULE FOR COMPUTING MOTOR BOAT PERFORMANCE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 405,041, filed Oct. 10, 1973, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a slide rule device for computing various performance parameters for motor boats.

From time to time, users of boats propelled by outboard motors, stern drive units, or inboard marine installations desire to know the approximate effect a change in engine horsepower and/or the gross weight of the boat will have on a boat speed. In lieu of an actual trial, the effect can be approximated by computing a performance factor which is the function of the boat gross weight, the engine horsepower and the boat speed. The average person is not knowledgeable of the mathematical equations involved in determining this performance factor. Moreover, complicated, multiple computations are required, making manual or mental computing of this factor both time consuming and subject to error. Once the boat speed has been determined, it is also desirable to select a propeller which will provide the most efficient boat operation for that speed. Such a selection is usually made by referring to a catalog or the like.

SUMMARY OF THE INVENTION

According to the invention, there is provided a simple slide rule device including two relatively movable members having logarithmic scales which are calibrated to respectively indicate boat gross weight, engine horsepower, boat speed and a performance factor indicative of the boat efficiency. The scales are arranged in interrelationship so the performance factor can be easily and quickly computed by simply moving the members relative to each other to align the appropriate values on adjacent scales.

More specifically, the slide rule device includes a first logarithmic scale on a first member and having graduated units for indicating boat gross weight, a second logarithmic scale on a second member adjacent the first or gross weight scale and having graduated units for indicating engine horsepower, a third logarithmic scale on either the first or second member and having graduated units for indicating boat speed, and a fourth logarithmic scale on the other member (i.e., the member other than the one on which the boat speed scale is located) adjacent the boat speed scale and having graduated units for indicating a boat performance factor. At least one of the first and second scales includes portions of first and second successive logarithmic cycles of the same length and the other scale includes at least a portion of a logarithmic cycle of the same length as the first and second cycles. The third or boat speed scale and the fourth or boat performance factor scale each include at least a portion of one logarithmic cycle having a length twice that of the logarithmic cycles of the first and second scales. The four scales are located on the members in an interrelated manner such that, when the graduations of one of the first and second scales are aligned with the graduations of the second logarithmic cycle of the other scale, the graduations of the third and fourth scales are aligned whereby the performance factor is equal to boat speed in miles per hour times the square root of the quotient of boat gross weight in pounds divided by engine horsepower.

Preferably, the two members are generally flat and rectangular with one being a base member in the form of a flattened sleeve and the other being a slide member which is slidably received within the sleeve. The base member includes an elongated opening for viewing a portion of the front face of the slide member. Two of the scales are located on the base member and respectively extend thereon lengthwise along the upper and lower edges of the opening and the other two scales are located on the slide member and respectively extend lengthwise thereon adjacent to the upper and lower edges of the base member opening. Propeller selector charts listing the preferred type of propeller for use on a variety of different boats at different speeds can be provided on the rear faces of the base member and the slide member.

A principal feature of the invention is the provision of a simple slide rule device which is adapted to compute performance parameters for motor boats.

Another principal feature of the invention is the provision of a slide rule device adapted to compute a performance factor for motor boats, which factor is indicative of boat efficiency.

A further principal feature of the invention is the provision of such a slide rule device including means for selecting the proper propeller for a particular type boat at different speeds.

Other features, aspects, and advantages of the invention will become apparent upon reviewing the following detailed description, the drawing, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front plan view of the slide rule device embodying various of the features of the invention.

FIG. **2** is a sectional view taken along the line designated 2—2 **in FIG.** 1.

FIG. **3** is a fragmentary, rear plan view of the slide rule device shown in FIG. **1.**

FIG. **4** is a front plan view of the slide rule device shown in FIG. **1** shown with a slide member in a position where the graduations of adjacent scales are aligned.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before explaining the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawing. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

Illustrated in the drawing is a slide rule device **10** including a flat, rectangular base member **12** which has a front face **14** and a rear face **16** and is adapted to slidably receive a flat, rectangular slide member **18** which has a front face **20** and a rear face **22.** While other arrangements can be used, in the specific construction

illustrated, the base member **12** is in the form of a flattened sleeve having opposed front and rear side walls **24** and **26** which are spaced apart by a pair of parallel spaced, elongated spacer sections **28** and **30** (See FIG. **2**). The spacer sections **28** and **30** provide the necessary spacing between the side walls **24** and **26** for affording slidable movement of the slide member **18** and also serve as guides for the opposite edges **32** and **34** of the slide member **18.** Both the base member **12** and the slide member **18** preferably are constructed from an opaque, relatively thin material, such as cardboard, plastic, and the like. If desired, the spacers sections **28** and **30** can be omitted.

Provided in the front side wall **24** of the base member **12** for viewing a portion of the front face **20** of the slide member **18** is a generally rectangular window or opening **36** including parallel, longitudinally spaced upper and lower edges **38** and **40.** While the upper edge **38** and the lower edge **40** of the opening **36** can be equally spaced along their entire lengths, in the specific construction illustrated, the lower edge **40** includes a cut out portion **42** through which a limited portion of the front face **20** of the slide member **18** can be viewed.

Located on the front face **14** of the base member **12** and extending lengthwise thereon adjacent the upper edge **38** of the opening **36** is a first logarithmic scale **44** which has calibrated graduations for indicating boat gross weight in pounds and increases in value from left to right. The boat gross weight scale **44** includes portions of at least two successive logarithmic cycles having the same length. In the specific embodiment illustrated, the boat gross weight scale **44** includes portions of two successive logarithmic cycles and increases in values from 150 to 10,000 pounds. If the slide rule device **10** is to be used for larger boats, the boat gross weight scale **44** can include one or more additional successive logarithmic cycles of the same length.

As used herein, logarithmic scale means a scale having graduations which are spaced in logarithmic relation i.e., the actual distances of the graduations from the origin are proportional to the logarithms of the corresponding graduation numbers rather than to the numbers themselves. As used herein, a logarithmic cycle means each portion of a logarithmic scale where the distance or spacing between successive equivalent graduated units progressively decreases until reaching a point where the same pattern of spacing is repeated. The start of each successive new cycle has a value 10 times that of the start of the preceding cycle. For example, referring to FIG. **1.**, the graduations of the boat gross weight scale **44** having the indicated values of 150 to 1,000 constitute a portion of a first logarithmic cycle and the graduations of the boat gross weight scale **44** having the indicated values of 1000 to 10,000 constitute a second or succeeding logarithmic cycle having the same length as the first logarithmic cycle.

Located on the front face **20** of the slide member **18** and extending thereon adjacent to the upper edge **38** of the base member opening **36** and parallel to the boat gross weight scale **44** is a second logarithmic scale **46** which has calibrated graduations for indicating engine horsepower and increases in value from left to right. The engine horsepower scale **46** includes portions of at least one logarithmic cycle having the same length as the logarithmic cycles of the boat gross weight scale **44.** In the specific embodiment illustrated, the engine horsepower scale **46** includes portions of two successive logarithmic cycles and increases in value from 20 to 600 horsepower. The spacing between the graduations of the engine horsepower scale **46** having the indicated values of 20 to 100 and 100 to 400 is the same as that for the graduations of the boat gross weight scale **44** having the indicated values of 200 to 1000 and 1000 to 4000, respectively. Thus, the graduations of the engine horsepower scale **46** can be aligned with the graduations of the boat gross weight scale **44** by moving the slide member **18** relative to the base member **12.** In the specific embodiment illustrated, when the graduations of these two scales are aligned along their lengths each calibrated unit of the engine horsepower scale **46** is equal in value to **10** units of the boat gross weight scale **44.** When the graduations of the first cycle of the engine horsepower scale **46** are aligned with the graduations of the second cycle of the boat gross weight scale **44,** each calibrated unit of the engine horsepower scale **46** is equal in value to 100 units of the boat gross weight scale **44.**

Located on the front face **20** of the slide member **18** and extending lengthwise thereon adjacent to the lower edge **48** of cut out portion **42** is a third logarithmic scale **50** which has calibrated graduations for indicating boat speed in miles per hour. The boat speed scale includes at least a portion of one logarithmic cycle having a length twice that of each of the logarithmic cycles of the boat gross weight scale **44** and the engine horsepower scale **46.** The boat speed scale **50** increases in value from left to right and includes that portion of the logarithmic cycle encompassing the expected range of speeds for the types of boats with which the slide rule device **10** is to be used. In the specific embodiment illustrated, the boat speed scale **50** includes an entire logarithmic cycle ranging from 10 to 100 miles per hour.

Located on the front face **14** of the base member **12** and extending lengthwise thereon adjacent to the lower edge **48** of the cut out portion **42** and parallel the boat speed scale **50** is a fourth logarithmic scale **52** which has calibrated graduations for indicating a boat performance factor. The boat performance factor scale **52** includes at least a portion of one logarithmic cycle having a length the same as that for the boat speed scale **50,** i.e., twice the length of each logarithmic cycle of the boat gross weight scale **44** and the engine horsepower scale **46.** The boat performance factor scale **52** increases in value from left to right and includes that portion of the logarithmic cycle encompassing the expected range of performance factors for the types of boats with which the slide rule device **10** is to be used. In the specific embodiment illustrated, the boat performance factor scale **52** includes a portion of the logarithmic cycle ranging from 140 to 200. The spacing between the graduations of the boat speed scale **50** having the indicated values of 14 to 20 is the same as that for the graduations of the boat performance factor scale **52** having the indicated values of 140 to 200. Thus, the graduations of the boat speed scale **50** can be aligned with the graduations of the boat performance factor scale **52** by moving the slide member **18** relative to the base member **12** and, when in this position, each graduated unit of the boat speed scale **50** is equal in value to 10 units of the boat performance factor scale **52.**

With this arrangement, the scales **44, 46, 50** and **52** are interrelated in a manner so that a performance fac-

tor indicative of a boat efficiency can be computed in accordance with the following equation:

$$\text{Performance factor} = \text{boat speed (MPH)} \sqrt{\frac{\text{boat gross weight (lbs)}}{\text{engine horsepower}}}$$

As used herein, the boat gross weight is the total weight of the boat, engine, passengers, gasoline, auxiliary equipment and gear, etc. To accomplish this computation, the scales are positioned relative to each other so that the graduations of the boat speed scale **50** are aligned with the graduations of the boat performance factor scale **52** when the graduations of the first logarithmic cycle of the engine horsepower scale **46** are aligned with the graduations of the second logarithmic cycle of the boat gross weight scale **44.** For example, referring to FIG. **4,** it can be seen that, when the graduation on the engine horsepower scale **44** representing 20 horsepower is aligned with the graduation on the boat gross weight scale **44** representing 2000 pounds, all the remaining corresponding graduations on these two scales are aligned and the graduation on the boat speed scale **50** representing 15 miles per hour is aligned with the graduation on the boat performance factor scale representing **150** with all the remaining corresonding graduations on these latter two scales being aligned.

The scales **44, 46, 50** and **52** can be located on the base member **12** and the slide member **18** in various manners so long as the boat speed scale **50** and the performance factor scale **52** are adjacent each other, the gross weight scale **44** and the engine horsepower scale **46** are adjacent each other, and the above-discussed interrelationship of the scales with respect to alignment of the respective logarithmic cycle graduations thereof is provided. For instance, the engine horsepower scale **46** can be located on the base member **12** adjacent to the upper edge **38** of the opening **35** with the boat speed scale **50** being located on the base member **12** adjacent to the opening lower edge **40,** the gross weight scale **44** located on the slide member **18** adjacent to the opening upper edge **38,** and the performance factor scale **52** located on the slide member **18** adjacent to the opening lower edge **40.** In this case, the opening **35** does not include the cut out portion **42,** as illustrated in FIG. **1,** but instead the upper edge **38** and the lower edge **40** thereof are equally spaced along their entire lengths. Also, if desired, a second opening can be provided in the rear face **16** of the base member **12** with the boat speed scale **50** being located on the rear face of the base member **12** or the slide member **18** and the performance factor scale **52** located on the rear face of the other member adjacent the boat speed scale **50.** Further, the lengths of the base member **12** and the slide member **18** can be extended and all the scales located along the same adjacent edges of the opening **36** and the slide member **18,** in which case the boat speed scale **50** and the boat performance scale **52** are longitudinally spaced from the boat gross weight scale **44** and the engine horsepower scale **46.**

Performance of the motor boat (i.e., one propelled by an outboard motor, a stern drive unit, or an inboard marine installation) can be approximately predicted when the gross weight of the boat and the engine horsepower is known. Many different factors, such as hull design, weight distribution, bottom condition, and propeller design, have an effect on boat performance. Therefore, boat performance can only be approximated without actual testing. The performance factor calculated in accordance with the above equation is an indication of the efficiency of the boat. From experience, it has been found that the performance factor is normally within the range of about 155 and 180 for pleasure boats and is usually higher than 180 for race boats.

In the embodiment illustrated, the longitudinal dimension of the cut out portion **42** generally corresponds to the range of typical performance factors for pleasure boats and race boats. As shown in FIG. **1,** indicia **53** can be included in conjunction with the performance factor scale **52** for indicating the normal upper and lower limits of the performance factor for pleasure boats and race boats.

When the boat speed, the gross weight of the boat, and engine horsepower are known, the slide rule device **10** can be used in the following manner to determine what effect a different sized motor and/or change in the boat load will have on boat speed. For example, assume that a boat having a gross weight of 2000 pounds and a 20 horsepower engine travels at a top speed of 17 miles per hour. The performance factor for that boat can be determined with the slide rule device **10** by moving the slide member relative to the base member **12** to align the value 20 on the engine horsepower scale **46** with the value 2000 on the boat gross weight scale **44** (See FIG. **4**). The value 170 on the boat performance scale **52** opposite to the value 17 on the boat speed scale **50** is the performance factor for that boat. It the engine is replaced with a 40 horsepower engine, the new top speed of the boat can be predicted by moving the slide member **18** until the value 40 on the engine horsepower scale **46** is aligned with the value 2000 on the boat gross weight scale **44.** The boat speed of 24 miles per hour is read on the boat speed scale **50** opposite to the previously determined performance factor 170 on the boat performance factor scale **52.**

When the boat speed is unknown, the performance factor for the boat is estimated. An accurate estimation of the performance factor requires some judgment based on experience with the particular type of boat being used. However, a performance factor between 155 and 170 normally can be safely used for pleasure boats without introducing a substantial error. To obtain the predicted boat speed, the slide member **18** is moved relative to the base member **12** until the appropriate values on the gross weight scale **44** and the engine horsepower scale **46** are aligned and the boat speed is read on the boat speed scale **50** opposite to the value on the performance factor scale **52** for the previously estimated performance factor.

Also in accordance with the invention, charts listing the preferred propeller for a variety of different type boats at different speeds are provided on the rear face **16** of the base member **12** and on the rear face **22** of the slide member **18.** In a specific construction illustrated, a chart **54** indicating the part number and/or other identification of the preferred type of propellers for boats propelled by an outboard motor is provided on the rear face **15** of the base member **12** and a similar chart **56** listing the part number and/or other identification of the preferred type of propellers for boats propelled by a stern drive unit are provided on the rear face **22** of the slide member **18.** As shown in FIG. **2,**

both of the charts **54** and **56** list the preferred propeller for a specific type boat and a specific range rule device **10** as described above, the appropriate chart **54** or **56** is referred to select the preferred propeller for the boat at that speed.

Although the slide rule device **10** has been described and illustrated as a rectilinear slide type construction, it will be apparent that the device can be arranged in a well known manner to utilize circular or cylindrical type scales so long as the above-described relationships are maintained between the scales **44, 46, 50** and **52.**

Various of the feature of the invention are set forth in the following claims.

I claim:

1. A slide rule device for computing performance of a motor boat comprising a first member, a second member mounted for movement relative to said first member, a first logarithmic scale on said first member and having graduated units for indicating boat gross weight in pounds, a second logarithmic scale on said second member and having graduated units for indicating engine horsepower, said first and second scales being adjacent with said graduated units thereof being alignable by relative movement of said members, a third logarithmic scale on said second member and having calibrated units for indicating boat speed in miles per hour, and a fourth logarithmic scale on said first member and having graduated units for indicating a boat performance factor which is indicative of boat efficiency, said third and fourth scales being adjacent with said graduated units thereof being alignable by relative movement of said members, one of said first and second scales including portions of first and second successive logarithmic cycles of the same length and the other of said first and second scales including a portion of a logarithmic cycle of the same length as said logarithmic cycles of said one scale, said third and fourth scales including a portion of a logarithmic cycle having a length twice that of said logarithmic cycles of said first and second scales, and said first, second, third, and fourth scales being interrelated such that, when said graduations of said other of said first and second scales are aligned with said graduations of said second logarithmic cycle of said one scale, said graduations of said third and fourth scales are aligned, whereby said performance factor is equal to boat speed in miles per hour times the square root of the quotient of boat gross weight in pounds divided by engine horsepower.

2. A slide rule device according to claim **1** wherein said first member has a front face including spaced upper and lower edges defining an elongated opening located in said front face thereof, said second member has a front face and is slidably carried by said first member for longitudinal movement relative to said opening, the two scales on said first member being respectively located on the front face thereof adjacent to the upper and lower edges of said opening, and the two scales on said second member being located on the front face thereof and respectively adjacent to the upper and lower edges of said opening.

3. A slide rule device according to claim **2** wherein said first scale is located on said base member and extends lengthwise thereon adjacent to the upper edge of said opening, said second scale is located on said slide member and extends lengthwise thereon adjacent to the lower edge of said opening, and said fourth scale is located on said base member and extends lengthwise thereon adjacent to the lower edge of said opening.

4. A slide rule device according to claim **2** including an elongated cut out portion in said lower edge of said first member having a longitudinal dimension generally corresponding to the normal range of performance factors for pleasure boats and race boats and having a lower edge, said performance factor scale being located adjacent said lower edge of said cut out portion and said boat speed scale communicating only with said cut out portion.

5. A slide rule device according to claim **1** wherein said first and second members have rear faces, and means located on one of said rear faces for identifying the appropriate propeller to be used for variety of boat types at different ranges of speed.

6. A slide rule device for computing performance of a motor boat comprising a first member, a second member mounted for movement relative to said first member, a first logarithmic scale on said first member and having calibrated units for indicating boat gross weight in pounds, a second logarithmic scale on said second member and having calibrated units for indicating engine horsepower, said gross weight and engine horsepower scales being adjacent with said calibrated units thereof being alignable by relative movement of said members, a third logarithmic scale on said second member and having calibrated units for indicating boat speed in miles per hour, and a fourth logarithmic scale on said first member and having calibrated units for indicating a boat performance factor which is indicative of boat efficiency, said boat speed and performance factor scales being adjacent with said calibrated units thereof being alignable by relative movement of said members, said first, second, third and fourth scales being oriented such that said performance factor is equal to boat speed in miles per hour times the square root of the product of boat gross weight in pounds divided by engine horsepower.

7. A slide rule device according to claim **6** wherein said first member has a front face including spaced upper and lower edges defining an elongated opening located in said front face thereof, said second member has a front face and is slidably carried by said first member for longitudinal movement relative to said opening, the two scales on said first member being respectively located on the front face thereof adjacent to the upper and lower edges of said opening, and the two scales on said second member being located on the front face thereof and respectively adjacent to the upper and lower edges of said opening.

8. A slide rule device according to claim **7** including an elongated cut out portion in said lower edge of said first member, having a longitudinal dimension generally corresponding to the normal range of performance factors for pleasure boats and race boats, and having a lower edge, said performance factor scale being located adjacent said lower edge of said cut out portion and said boat speed scale communicating only with said cut out portion.

9. A slide rule device according to claim **6** wherein said first and second members have rear faces, and means located on one of said rear faces for identifying the appropriate propeller to be used for a variety of boat types at different ranges of speed.

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